Introductory Statement

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THE PAPERS PUBLISHED in this issue were presented in a symposium with the theme Canopy Dieback and Dynamic Processes in Pacific Forests, which was held at the 15th Pacific Science Congress in Dunedin, New Zealand, 1–12 February 1983. Co-organizers were D. R. McQueen (Botany Department, Victoria University of Wellington, New Zealand) and D. Mueller-Dombois (Department of Botany, University of Hawaii at Manoa, Honolulu).

The history goes back to 1981, when my wife and I spent a sabbatical of research and travel in Australia, the Melanesian Islands, and New Zealand. One of the objectives was to look for forests with canopy dieback similar to that found in the Hawaiian *Metrosideros* rain forest ecosystem (Mueller-Dombois 1980). This dieback is characterized by monospecific canopy stands, in Hawaii represented by *M. polymorpha*, that are losing or have lost their foliage more or less simultaneously as if they were deciduous tree stands. The spatial pattern of dieback is patchy, but patch sizes vary from less than a hectare to over 10 ha and their boundaries often coincide with major soil boundaries. No obviously violent perturbations, such as fire, hurricanes, landslides, or floods are directly involved in this foliage loss and mortality phenomenon, although violent perturbations may be indirectly involved.

A number of such forests with dieback stands were seen, most notably *Nothofagus pullei* dieback stands on Mt. Giluwe in Papua New Guinea, *Eucalyptus deglupta* dieback stands in tropical humid lowland rain forests on the island of New Britain, and *Nothofagus solandri* var. *cliffortioides* and *Metrosideros umbellata–Weinmannia racemosa* dieback stands on New Zealand's South Island.

For the field introduction to South Pacific forests with such dieback phenomena, I am indebted to Frans Arentz, with whom I traveled to Mt. Giluwe; to D. Ross McQueen, who guided us through the indigenous forests on the North and South Islands of New Zealand; and to Udo Benecke, who provided a field introduction to the stand dynamics of the monospecific *Nothofagus solandri* var. *cliffortioides* forest ecosystem in Craigieburn Forest Park.

The timeliness of this symposium is evidenced by the following:

(1) On a visit to Tongariro National Park on the North Island of New Zealand, Ross McQueen introduced us to an unexplained *Nothofagus solandri* var. *cliffortioides* dieback in a mixed species indigenous forest. This dieback had troubled the Park Service personnel for lack of satisfactory answers to the general public's frequent inquiries about the reason for this aggravated tree mortality. Also, was the Park Service preserving a dying forest which was occupying land that could perhaps be better utilized by a productive plantation forest of *Pinus radiata*? Discussion with Chief Park Ranger Bruce Jefferies revealed that a local symposium was planned for March 1982 in Tongariro National Park, where the question of this unexplained beech mortality would be discussed by a group of experts. The Tongariro symposium has since been published (Silvester and Watt 1983), and some of the participants contributed to our present symposium.

(2) When we visited Westland National Park on the South Island, Ross McQueen showed us the recently glaciated valley of Franz Josef Glacier. The slopes of this valley are dominantly occupied by a temperate *Metrosideros umbellata–Weinmannia racemosa* rain forest. An interesting phenomenon in this valley is the 1750 trimline (dating from 1750), a demarcation line left on the slope by the glacier when it retreated toward the head of the valley. This line is now clearly marked by a dieback forest above and a vigorous green forest below, both of which are dominated by *M. umbellata* and *W. racemosa*. The sharp historical boundary between dieback and nondieback forest was reminiscent of a similar situation displayed in the Hawaiian *M. polymorpha* forest on adjacent lava flows, which often separate a dieback from a nondieback forest (Jacobi 1983).

However, all along, we had been impressed by the prevailing opinion in New Zealand that the widespread *Metrosideros–Weinmannia* dieback was caused by the introduced Australian possum. This interpretation has found its way into ecological textbooks (e.g., Walter 1960), and it is reiterated in this symposium by Les Batcheler (pages 415–426). Without a natural enemy, the possum has indeed increased to epidemic proportions, and dead carcasses are frequently encountered along New Zealand's highways. Yet, how could a sharp historical demarcation line now separating a dieback from a nondieback forest be reinforced by possum browsing unless the Park Service had built a fence there that would effectively prevent possum from drifting into the area below the 1750 trimline? One explanation given in an excellent vegetation description for Westland National Park (Wardle and West 1979) is that possums prefer mature over immature trees, because mature trees have cavities in which possums find shelter. When I asked Westland Park Naturalist Gerry McSweeny about a possible fence along the 1750 trimline, he smiled and gave me two unpublished reports in which the authors question the sole responsibility of possum as the cause of canopy dieback and tree mortality. Two of these authors have since published several papers (Stewart 1982, Stewart and Veblen 1982, Veblen and Stewart 1982), and they contributed significantly to this symposium (pages 427–431). These authors came independently to the same conclusion about dieback for the New Zealand *Metrosideros* forest (with possum) as I did for the Hawaiian *Metrosideros* forest (which does not include possum); namely, that stand-level or canopy dieback is ultimately linked to stand or tree population dynamics in these cases. I have formulated this interpretation into what I have termed "the cohort senescence" theory, which is explained in the paper following this introductory statement.

(3) Canopy dieback has traditionally been considered a pathological problem. As such, foresters have tended to transfer dieback problems to another discipline, and forest pathologists have accommodatingly found fungi or insects in association with dying tree stands (Mueller-Dombois et al. 1983). This association is often characterized by correlations found with cull and loss of productivity in affected trees. Thus, biotic disease research has been justified by economic reasons alone, but causal relationships have often been left unclarified. Moreover, pathological concern with dying trees has commonly led to a neglect of observations relating to tree reproduction and the effects of dieback on the rest of the community. Successional relationships, in turn, are a traditional preoccupation of forest ecologists. Yet ecologists have generally accepted tree death as normal and thus have not given much thought to the etiology of tree-group dieback. Consequently, a knowledge gap exists in this

area of forest dynamics, because it falls between the realms of three disciplines: forestry, pathology, and ecology.

It is hoped that this symposium will be a step toward closing this knowledge gap by encouraging closer interdisciplinary communication and cooperation.

(4) This is the first international symposium that exposes the canopy dieback problem as widespread in the Pacific region. It follows a sequence of recent symposia held in this region at the local and national levels in Australia (Old, Kile, and Ohmart 1981), New Zealand (Silvester and Watt 1983), and Hawaii (Mueller-Dombois et al. 1980). These activities indicate a growing concern which undoubtedly will gain perspective through broader comparisons.

(5) In view of the fact that canopy dieback in the industrialized regions of the Atlantic is currently receiving great attention (Smith 1981, Ulrich 1981, 1982, Vogelmann 1982), it is particularly timely now to unravel the ecological basis of canopy dieback and its consequences. In eastern North America and Canada as well as in central Europe and Scandinavia, canopy dieback is now linked to industrial pollution in the form of acid rain, nitrous oxide, and/or heavy metal deposition. Therefore, new environmental stresses on the forests of the Atlantic region are currently under investigation; while in the forests of the central and south Pacific region, canopy dieback occurs without industrial pollution. Different environmental stresses such as disease, animal damage, and climatic perturbations are emphasized in the Pacific region. However, in this symposium—perhaps, for the first time—internal stresses that may reside within the dieback populations themselves are given equal emphasis. By exposing these alternate mechanisms and by exploring how they interact in different situations, it may be possible to view the forests with canopy dieback in the central and south Pacific region as biological controls against which canopy dieback in the Atlantic region may be compared.

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